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ABSTRACT

This booklet outlines a course designed to equip major appliance service students with the fundamental knowledge and understanding of procedures, basic electrical circuitry, and nomenclatures of components necessary in successfully tracing a circuit and repairing or replacing a malfunctioning component. Course content includes goals, specific block objectives, orientation, refrigeration components, schematics and cycle charts, major appliance circuit testing, domestic refrigeration fans, a bibliography, a post-test, and the appendix is a post-test sample. (NH)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

Course Outline
APPLIANCE REPAIR 3 - 9027
(Refrigeration Controls: Electrical and Mechanical)
Department 48 - Quin 9027.02

DIVISION OF INSTRUCTION • 1973

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D A D E C O U N T Y P U B L I C S C H O O L S
1450 NORTHEAST SECOND AVENUE
M I A M I, F L O R I D A 33132

Course Outline

APPLIANCE REPAIR 3 - 9027
(Refrigeration Controls: Electrical and Mechanical)

Department 48 - Quin 9027.02

county office of
VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

March, 1973

Published by the School Board of Dade County

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Course Description

9027	48	9027.02	Refrigeration Controls: Electrical and Mechanical
State Category Number	County Dept. Number	County Course Number	Course Title

This course includes refrigerant metering devices, temperature controls, defrost heaters, thermostats and air circulation fans. Also included is basic electrical control circuitry and circuit tracing procedures. This is a one or two quinmester credit course.

Indicators of Success: Prior to entry into this course the student will display mastery of the skills indicated in The Refrigeration System (9027.01)

Clock Hours: 45, 90

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PREFACE

The following quinmester course outline is presented to provide the major appliance service student with a fundamental knowledge of the procedures necessary to apply his understanding of basic electrical circuitry and nomenclatures of components, necessary in order to successfully trace a circuit and repair or replace a malfunctioning component.

This quinmester course may be taught in a single quinmester session for 45 clock hours or in a double quinmester session for 90 clock hours. In each instance the course consists of six instructional blocks, however, the double session permits the student to cover each block in more detail and also provides added opportunity to practice and increase his skills.

Manipulative instructional methods include demonstration and shop use of actual appliances, tools and equipment as well as mock-ups.

Related instruction is taught through lecture, books, service manuals, instructional sheets and chalk-board presentations. Students are expected to keep notebooks and to complete daily related and manipulative assignments. Opportunity is provided for practicing newly learned manipulative skills.

An adjunct to the listed instructional methods is provided through the instructors utilization of audiovisual equipment and materials.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

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with Suggested Hourly Breakdown

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BLOCK

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	Introduction	1
	Student Responsibilities	1
	Course Benefits	1
II.	REFRIGERATION COMPONENTS (50 Hours)	
	Operational Controls	1
	Temperature Controls	2
	Mechanical Control Components	2
	Refrigerant Control Components	2
III.	SCHEMATICS AND CYCLE CHARTS (30 Hours)	
	Schematics	2
	Pictorial Diagram	2
	Cycle Charts	2
IV.	MAJOR APPLIANCE CIRCUIT TESTING (20 Hours)	
	Electrical Measurements	3
	Tracing Circuit	3
V.	DOMESTIC REFRIGERATION FANS (30 Hours)	
	Circulating Fans	3
	Fan Motors	3
	Troubleshooting and Repair	4
VI.	QUINMESTER POST-TEST	

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GOALS

The student must be able to:

1. Demonstrate an understanding of the different types of controls used in refrigeration and be able to explain the function of each one as related to the refrigeration unit.

2. Draw a diagram of the circuit relating to the operational controls in a refrigeration unit.

3. Trace a schematic through different components in order to determine if a component is malfunctioning.

4. Trace a circuit using a pictorial drawing of the refrigeration unit.

5. Diagnose and repair or replace any malfunctioning component in the refrigeration unit.

6. Satisfactorily complete the quinmester post-test.

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SPECIFIC BLOCK OBJECTIVES

BLOCK I - ORIENTATION

The student must be able to:

1. Describe and explain the functions of the mechanical and electrical refrigeration controls as used in the major appliance service industry.
2. Demonstrate through daily practice an understanding of the safety rules and regulations involved in the electrical and refrigeration work.

BLOCK II - REFRIGERATION COMPONENTS

The student must be able to:

1. Identify all motor and temperature controls used in domestic refrigeration and air conditioning units.
2. Explain how a metering device functions in a domestic refrigeration appliance.
3. Explain the operation of the defrost controls as used in the major appliance service field.

BLOCK III - SCHEMATICS AND CYCLE CHARTS

The student must be able to:

1. Interpret schematics and cycle charts of any domestic refrigeration unit.
2. Identify all components and wiring in a pictorial diagram of a domestric refrigeration unit.

BLOCK IV - MAJOR APPLIANCE CIRCUIT TESTING

The student must be able to:

1. Use a test lamp and test cord on a refrigerating unit to test various circuits.
2. Use various electrical test instruments on a refrigeration unit to determine a malfunctioning component.
3. Trace the various circuits in a domestic refrigeration unit by color coded wires and a schematic or pictorial diagram.
4. Read a cycle of operations chart and determine if the unit is operating properly.

BLOCK V - DOMESTIC REFRIGERATION FANS

The student must be able to:

1. Identify and explain the design and function of circulating fans as used in major appliance service refrigeration units.
2. Explain and describe the functions and designs of fan motors.

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3. Repair and/or replace defective fan motors.
4. Trace a circuit to find a malfunctioning component and repair or replace this component.
5. Check and test a refrigeration unit after a malfunction has been corrected.

BLOCK VI - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete the quinmester post-test.

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Course Outline

APPLIANCE REPAIR 3 - 9027
(Refrigeration Controls: Electrical and Mechanical)

Department 48 - Quin 9027.02

I. ORIENTATION

A. Introduction
   1. Types of controls
      a. Mechanical controls
      b. Electrical controls
   2. Electric circuits
      a. Types of circuits
      b. Tracing procedures
   3. Fans
      a. Types of fans
      b. Location and use

B. Student Responsibilities
   1. Safety
      a. Protective clothing
      b. Safety regulations
      c. Safety equipment
   2. School regulations
      a. Shop rules
      b. Tool and equipment maintenance
      c. Clean-up assignments

C. Course Benefits
   1. Career opportunities
      a. Shop technician
      b. Component manufacturing
      c. Field technician
   2. Schematics and diagrams
      a. Recognizing types
      b. Pictorial diagrams
      c. Interpretation of schematics

II. REFRIGERATION COMPONENTS

A. Operational Controls
   1. Motor Controls
      a. Thermostats
      b. Relays
      c. Overload switch
   2. Solenoids
   3. Timers
   4. Heaters
      a. Defrost
      b. Cabinet
   5. Switches - light switch

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B. Temperature Controls
   1. Thermostat
      a. Cabinet
      b. Freezer
      c. Air conditioner
   2. Relay
      a. Hot wire
      b. Voltage
      c. Current

C. Mechanical Control Components
   1. Vent control
   2. Airflow control

D. Refrigerant Control Components
   1. Metering devices
      a. Capillary tube
      b. Expansion valve
   2. Defrost controls
      a. Manual
      b. Temperature defrost
      c. Time defrost
      d. Hot gas defrost

III. SCHEMATICS AND CYCLE CHARTS

A. Schematics
   1. Electrical symbols
      a. Component symbols
      b. Wiring symbols
   2. Complete schematic
      a. Identifying symbols in circuit
      b. Visually trace circuits

B. Pictorial Diagram
   1. Pictorial drawings
      a. Electrical component drawing
      b. Wiring drawings
   2. Relating the pictorial to the schematic
      a. Terminal and wire lead identification
      b. Component identification and comparison

C. Cycle Charts
   1. Operational charts
      a. Operating time cycle
      b. Temperature cycles
      c. Pressure cycles
   2. Application of charts to appliance
      a. Tracing cycle on chart
      b. Identifying operating components

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IV. MAJOR APPLIANCE CIRCUIT TESTING

A. Electrical Measurements
   1. Test lamp
      a. Test for voltage
      b. Test for continuity
   2. Test cord
      a. Test for continuity
      b. Test operational circuit
      c. Test component circuit
   3. Voltmeter
      a. Check voltage in circuit
      b. Check voltage at source
      c. Check voltage at component
   4. Ammeter - amprobe
      a. Measure current
      b. Diagnose equipment malfunctions
   5. Wattmeter
      a. Check power
      b. Determine relationship to volts and amps
      c. Check component
   6. Ohmmeter
      a. Check circuit continuity
      b. Check component
      c. Measure resistance

B. Tracing Circuit
   1. Locating malfunctioning component
      a. Tracing wires to and from component
      b. Identifying component circuit
   2. Color code
      a. Identifying circuits by lead color
      b. Tracing circuits by lead color
   3. Using graphs to check operations
   4. Interpreting cycle of operations chart

V. DOMESTIC REFRIGERATION FANS

A. Circulating Fans
   1. Types of fans
      a. Axial flow
      b. Radial flow
   2. Fan drive
      a. Belt
      b. Direct
   3. Location of fan
      a. Squirrel cage
      b. Propeller
      c. Reason for design

B. Fan Motors
   1. Type motor
   2. Function

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3. Operating principles
4. Techniques of repairing or replacing
5. Diagnosing malfunctions
   a. Loose connections
   b. Dry bearings
   c. Worn bearings
   d. Burnt motor
   e. Loose fan
   f. Out of balance blades
   g. Blades hitting housing

C. Troubleshooting and Repair
1. Trace circuit to find malfunction
2. Repair or replace malfunctioning components
3. Check circuit after repair or replacement
4. Check component for proper operation
5. Check and test unit.

VI. QUINMESTER POST-TEST

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2. Basic Electrical Refrigeration Controls. Cassette R-10 #821229. La Porte, Indiana: Whirlpool Corporation.

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A P P E N D I X

Quinmester Post-Test Sample

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Quinmester Post-Test

Name _____ Date _____ Score ____

Multiple Choice Test Items

Each statement needs a word, a figure or a phrase to make it correct. Only one of the choices listed is correct. Place the number of the choice you make in the space provided at the left edge of the sheet.

____ 1. The high side is composed of the following components:

a. Suction line
b. Condenser and evaporator
c. Liquid line and condenser

____ 2. A condenser is a device for removing:

a. Heat
b. Noncondensable
c. Gases
d. Water vapor from system

____ 3. Within the condenser the refrigerant:

a. Boils
b. Condenses
c. Boils and condenses

____ 4. The condenser removes from the refrigerant:

a. Sensible heat only
b. Latent heat only
c. Both latent and sensible heat

____ 5. The main function of the evaporator in the system is to:

a. Change gas to liquid
b. Absorb heat
c. Condense water

____ 6. Another name that is used for the evaporator is:

a. Ice maker
b. Condenser
c. Cooling coil

____ 7. The low side is composed of the following components:

a. Suction line and condenser
b. Liquid line and evaporator
c. Suction line and evaporator

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___ 8. The most common method used to defrost the evaporator in modern household refrigerators is:

a. Manual defrost
b. Automatic clock defrost
c. Pressure switch defrost

___ 9. Evaporation takes place in refrigeration when there is a change in state from:

a. Gaseous to liquid
b. Gaseous to solid
c. Liquid to gaseous

___10. Manual defrost means that:

a. A time clock defrosts the refrigerator
b. All defrosting is done by hand
c. A button has to be pushed to defrost

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Quinmester Post-Test

Name _____ Date _____ Score ___

True-False Test Items

Each of the following statements is either true or false. Circle the "T" if you think the statement is true, and the "F" if you think the statement is false. If a statement is false in part, it is entirely false.

1. Some refrigeration systems use a voltage relay. T F
2. An overload protector is built into the hot wire relay. T F
3. If the suction line is cold and sweating, it indicates an undercharge. T F
4. Some air conditioning units have oil filled capacitors. T F
5. A starting capacitor could be an electrolytic type. T F
6. A shaded pole motor is never used in a domestic refrigerator. T F
7. Air cooled condensers are common in domestic refrigerators. T F
8. Domestic refrigerators having capillary tube systems, have a "critical charge" of refrigerant. T F
9. If the liquid line is much colder going into the drier, or at the drier, or leaving the drier, it indicates a restriction at that point. T F
10. A hissing noise should be heard inside the evaporator where the capillary tube enters. T F

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Quinmester Post-Test

Name _____ Date _____ Score ____

Symbols

Draw the symbol opposite the name of the component.

1. Capacitor

2. Battery

3. Circuit breaker

4. Fuse

5. Transformer

6. Solenoid

7. Ground

8. Crossover

9. Variable sign

10. Resistor

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ANSWER KEY TO QUINMESTER POST-TESTS

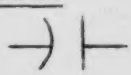
Multiple Choice

1. c
2. a
3. a
4. c
5. b
6. c
7. c
8. b
9. c
10. b

True-False

1. T
2. T
3. F
4. T
5. T
6. T
7. T
8. T
9. T
10. T

Symbols

1. 
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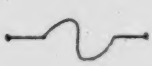
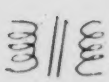
4. 
5. 
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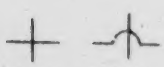
8. 
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